REMARKS

Accompanying this response, please find marked-up paragraphs of the specification which overcome some informalities noted in the specification. The undersigned avers that the enclosed replacement paragraph(s) of the specification do not contain any new matter.

In the event that there are any fee deficiencies or additional fees are payable, please charge the same or credit any overpayment to our Deposit Account (Account No. 04-0213).

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

[001] DIE-CASTING BRASS ALLOY WHICH IS RESISTANT TO DEZINCIFICATION

[002] **FIELD OF THE INVENTION**

[003] The present invention relates to a die-casting brass alloy, which is resistant to dezincification~~ according to the preamble of claim 1~~.

[004] **BACKGROUND OF THE INVENTION**

[005] Dezincification is a problem for brass water fittings, when the water quality varies and maybe is strongly corrosive.

[006] It is known , that it is possible to treat the copper rich alpha-phase in brass against dezincification by means of small additions of arsenic or antimony, whereas the zinc rich beta-phase is not resistant to dezincification.

[007] Thus, it would be logical to keep a high percentage of copper in a brass alloy resistant to dezincification (as an alloy 1 in Fig. 1, showing a portion of the phase diagram Cu-Zn, Hansen, Constitution of binary alloys, New York 1958) in order to minimize or completely avoid the amount of the less corrosive resistant beta-phase. The problem with such an alloy is, that it results in a primary solidification of the alpha-phase in the form of long solidification crystals, so called dendrites, which means, that the beta-phase will form long bands between the alpha-dendrites. This results in two negative consequences :

a) The material will be brittle by heat ; and
b) The material will obtain a deep dezincification, since the dezincification will follow the long beta-phase bands.

[008] This phenomenon is thoroughly described in the following scientific article: Arno Louvo, Tapio Rantala, Veijo Tauta, "The Effect of Composition on as-cast Microstructure of alfa/beta-Brass and its Control by Microcomputer", LISBOA 84, 51 st International Foundry Congress.

[009] Fig. 2, which has been excerpted from this article, describes the problem with brittleness by heat, and Fig. 3, which has been excerpted from the same article, the phenomenon with increasing dezincification depths with an increasing copper content.

[015] **SUMMARY OF THE INVENTION**

[016] This object is attained according to the invention by the development of an alloy having the following characteristics.

[017] By balancing copper, zinc, silicon and aluminum in a capable manner it is possible to attain a solidification in the beta-phase and nevertheless avoid the development of continuous beta-phase areas in the finished product. The beta-phase will be found in isolated agglomerates in a matrix of alpha-phase, which is protected against a dezincification due to the arsenic addition. The primary solidification in the beta-phase with the alloy combination according to the invention combined with the high solidification speed of the die-casting limits the size of the agglomerates of the beta-phase in the final casting structure, the agglomerates also in a thick die-casting material with a low solidification speed obtaining an extension, which is clearly less than 100 μm. By means of fine grain-treatment with boron the size of the agglomerates and consequently also the depth of the dezincification can be additionally reduced.

~~[018]~~

~~[019]~~

[018] BRIEF DESCRIPTION OF THE DRAWINGS

[019] The invention will now be described, by way of example, with reference to the accompanying drawings in which:

[020] Fig. 1 shows a portion of a phase diagram Cu-Zn;

[021] Fig. 2 describes a problem with brittleness by heat;

[022] Fig. 3 shows a phenomenon with increasing dezincification depths with an increasing copper content;

[023] Fig. 4 shows how the amount of peritecticly solidifying materials (solidification primarily in the alpha-phase) quickly is reduced, when the copper content in the alloy is reduced, whereas the increase of the amount in the beta-phase in the final structure increases relatively slowly;

[024] **Fig. 5 shows the r sult from investigations of th dezincification depth according to the international standard ISO 6509 for die-cast work pieces having a 6 mm thickness of material as to alloys having a varying Cu content; and**

[025] **Fig. 6 shows the result for the corresponding investigation with a material thickness of 16 mm.**

[026] **DETAILED DESCRIPTION OF THE INVENTION**

[027] These conclusions have been confirmed by the results of an extensive development effort during several years, the purpose of which has been to find appropriate alloy combinations. ~~This is shown in the following drawings :~~

[028] Fig. 4 shows how the amount of peritecticly solidifying materials (solidification primarily in the alpha-phase) quickly is reduced, when the copper content in the alloy is reduced, whereas the increase of the amount in the beta-phase in the final structure increases relatively slowly.

[029] Fig. 5 shows the result from investigations of the dezincification depth according to the international standard ISO 6509 for die-cast work pieces having a 6 mm thickness of material as to alloys having a varying Cu content. The result is unambiguous. A dezincification minimum is attained exactly in the area, where the peritectic solidification ceases, at the same time as the amount of beta-phase has not yet become too large. The figure shows a dezincification depth for a maximal separate value as well as median values for a number of measurements, done on the same test object. The result is , that in a relatively wide area the obtained result falls below the requirements regarding the dezincification resistance according to BS 2872 of maximally 100 μm for a separate value.

[030] The object of the invention is to suggest an alloy , which also meets the dezincification requirements for thick die-cast materials, and Fig. 6 shows the result for the corresponding investigation with a material thickness of 16 mm. Also for this material thickness the requirement is met, namely maximally 100 μm for a separate value but within a more narrow interval.

02/21/02 PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of	:	Carl-Åke DÄCKER and Ulla LANGELOTZ
Serial no.	:	
For	:	DIE-CASTING BRASS ALLOY WHICH IS RESISTANT TO DEZINCIFICATION
Docket	:	INTSER P27AUS

BOX PCT
The Commissioner of Patents and Trademarks
Washington, D.C. 20231

SUBMISSION OF PROPOSED DRAWING AMENDMENT FOR APPROVAL BY EXAMINER (37 CFR 1.123)

Dear Sir:

Attached hereto please find a copy of Figs. 1, 2 and 3 of the original drawings with red ink markings showing proposed changes to the drawing(s) of this application for which the approval of the Examiner is requested. Also enclosed are six (6) sheets of formal drawings which are to be entered in this case.

In the event that there are any fee deficiencies or additional fees are payable, please charge the same or credit any overpayment to our Deposit Account (Account No. 04-0213).

Respectfully submitted,

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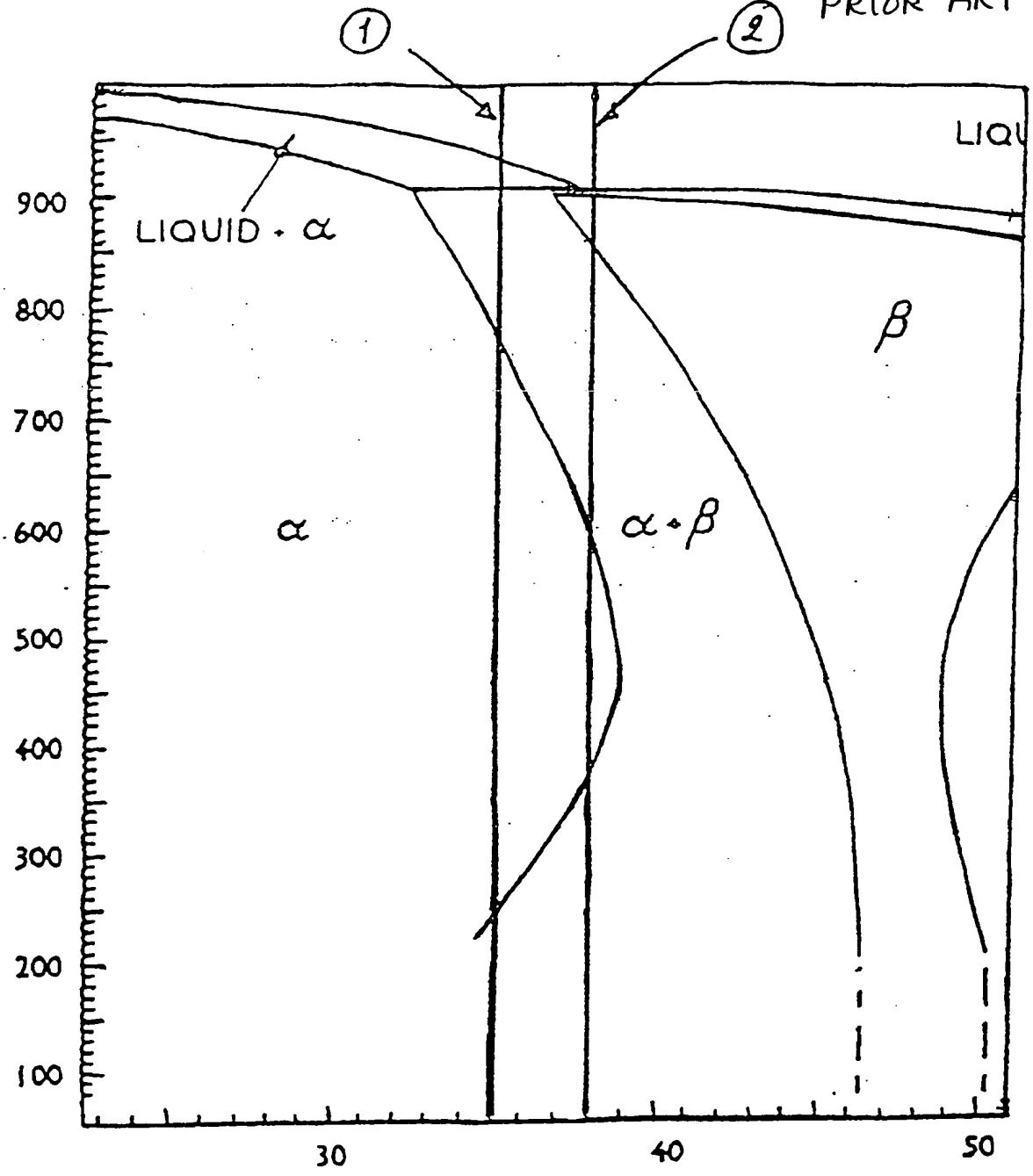
Fig. 1

PRIOR ART



Hot-learing tendencies and the binary copper-zinc phase diagram

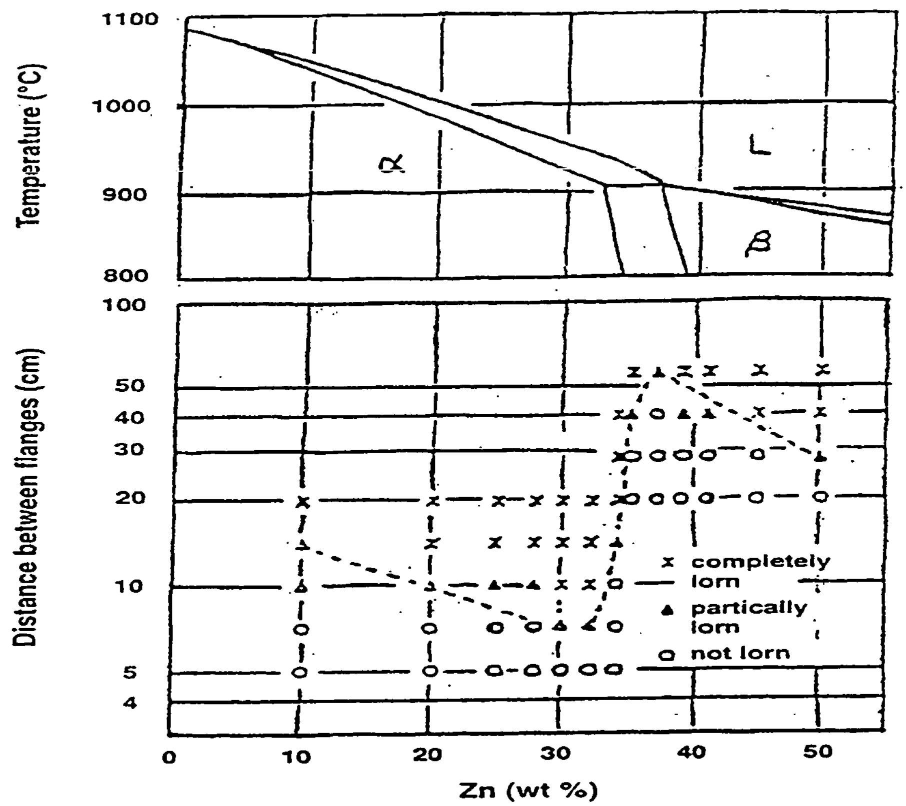


Fig. 2

PRIOR ART

The result of the dezincification tests.

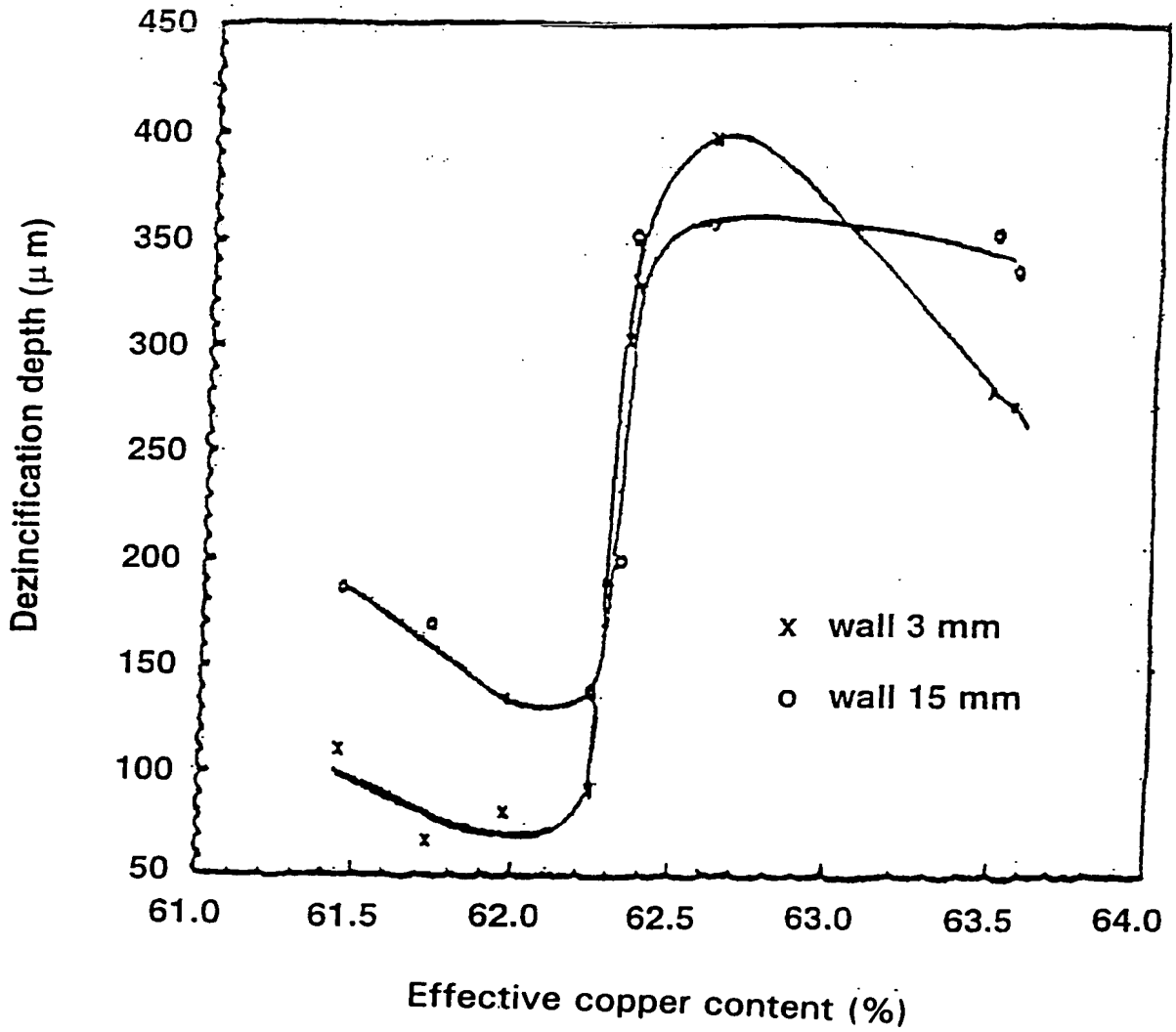


Fig. 3
PRIOR ART